

# **Maritime Meteorology Project (Monitoring and Services) for the Northwest African Basin and Macaronesia**

## **Project Outline**

*(August 2010)*

### **1. Introduction**

This document describes the practical, technical and financial conditions designed for the implementation of a 4-year Maritime Meteorology Project as an outcome of the **Las Palmas Action Plan for 2008 and Niamey Action Plan for 2009**.

### **2. Background**

A Memorandum of Understanding between the World Meteorological Organization (WMO) and the Meteorological State Agency (AEMET)<sup>1</sup> signed in July 2007 provides for and regulates the design and implementation of specific programs and projects for the benefit of NMHSs of developing countries.

Following Las Palmas Action Plan, an expert meeting on West Africa Marine Meteorology was held in Dakar (Senegal), from 27 to 29 February, at the Direction de Météorologie Nationale. Thirty participants from both NHMS and Maritime/Port authorities from Mauritania, Cape Vert, Morocco, Senegal, Cote d' Ivoire and Spain attended the meeting. This activity was a follow-up of the Las Palmas Action Plan and was supported in the framework of the Spanish cooperation in close collaboration with WMO.

Mauritania, Cape Vert, Morocco, Senegal and Cote d' Ivoire presented a diagnostic of the situation on marine meteorology in their region to provide valuable information on their capabilities to help identify their needs and requirements. An integrated Spanish proposal was presented and discussed. The group noted that the Spanish proposal covered the development of both marine meteorology and oceanographic products and services and would contribute to the needs expressed by the countries in the region to improve marine meteorological services for maritime safety and fisheries management.

A draft Terms of Reference (ToR) document was endorsed At the Conference of Directors of the West African NMHSs held in Niamey, Republic of Niger, 13 to 14 November 2008. The Directors Conference Agreed to go forwards with the Implementation of a pilot project according to this draft ToR for project on Marine Met-Ocean presented by Spain, being committed both the WMO Secretariat and AEMET to finalise this TOR whereas needed.

### **3. Overall Objective**

Recognizing the weakness revealed by a WMO survey in those countries regarding a lack of expertise in marine meteorology in their national meteorological services, as well as an absence of an effective warning and disaster mitigation strategy.

Taking into account that an important part of the population of West African countries lives in coastal cities, with their economic activities in the coastal zones, thus having growing demand for marine meteorology services and an urgent needs to enhance their operational capacity in this field.

The overall objective of this Project is therefore, to enhance the capacity of the NMHSs of West African coastal countries and provide them with the relevant tools that will allow them to contribute to the sustainable development of their respective countries and enhance the delivery

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<sup>1</sup> Former National Institute of Meteorology (INM)

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of products and services to the various socioeconomic sectors related to marine activity as it is essential for them.

### **4. Specific Objectives**

Development of a 4-year Maritime Meteorology Project:

- To support a node of marine meteorology research based on the WMO's SWFDP<sup>2</sup> Cascading Process or Principle. This node will make possible a close collaboration of Spain, the Regional Specialized Meteorological Centre (RSMC) at Dakar (RSMC-Dakar) and the NMHS participants in this project. Suggested Global Centers are: Météo-France, ECMWF, UK Met-Office and the NCEP.
- To build up capacity of West Africans NMHS involved so that they become autonomous regarding the activities of marine meteorology monitoring and forecasting.
- To provide specific tools and technology transfer to the West African NMHS involved in the project in order to improve marine meteorology predictions, and the enhancement of marine meteorological services for maritime safety and fisheries management.

### **5. Expected Benefits**

#### **5.1. For different areas:**

- Reduction of loss of lives and property;
- Reduction of damage to infrastructure;
- Provision of data for safe Navigation;
- Disaster prevention and preparedness;
- Improved fishing activities;
- Increased scientific and technical capacity;
- Improved knowledge of marine meteorology and ecology in West Africa and their relation with global change;

#### **5.2. For Government bodies and other institutions:**

- Government department for fisheries;
- Fishermen's organisations;
- Authorities responsible for safety of life at sea, including coastal waters;
- Authorities responsible for combating marine pollution;
- Operators of ferry, hydrofoil, hovercraft, or similar services;
- Oil drilling and shipping companies;
- Authorities responsible for protection of the coastal populations from, among others, high waves, storm surges and tsunamis;
- Harbour control authorities;
- Scientific institutions dealing Earth/Environment issues (oceanography, climate, marine biology...)
- WMO institutions in the Region (ACMAD)

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<sup>2</sup> Severe Weather Forecast Demonstration Project

**6. Participants in the Maritime Meteorology Project for the Northwest African Basin and Macaronesia (In Phase I -Pilot project)**

- Meteorological State Agency of Spain (AEMET)
- State Ports of Spain (PE)
- Las Palmas de Gran Canaria University (ULPGC).
- WMO (Ocean Affairs Division)
- The Regional Specialized Meteorological Centre (RSMC) at Dakar (RSMC-Dakar)
- ANAMs-ASECNA
- INMG/Cape Vert
- ONM/Mauritania
- DWR/The Gambia

*(In future phases, it could be open to new partners)*

**7. Coordination Committee**

A Coordination Committee will be established in order to seek efficiency on decisions, on the implementation process and a fast communication track as well as to provide guidance from a scientific, technical and operational point of view.

Composition:

For WMO: Edgar Cabrera

For the AEMET of Spain: Irene Sanz

For the INMG of Cape Vert: Angelo Cardoso

For the ONM of Mauritania: Sidi Ould Mohamed Lemine

For the DNM of Senegal: Sory Diallo

For the DWR of The Gambia: George Stafford

Responsibilities:

- Maintaining adequate international coordination.
- Monitoring project progress.
- Reviewing project status reports.
- Recommending project variations and future phases development.
- Resolving issues raised.
- Identifying future needs and priorities.
- Resolving data policy issues.
- To study the scientific, technical and operational implications of any changes to the project objectives.
- To coordinate relations with the users and recommend any necessary action.
- To maintain and seek an adequate international coordination of programmes.
- To keep under review the performance of the flow and the quality of the data, products and services.
- To suggest in the light of the above review, changes in the project.
- To review budget proposals from a technical and scientific point of view.
- To study future phases and future requirements related to the project.

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### 8. Budget issues

#### 8.1. Equipment implementation:

##### 8.1.1. *Equipment to be financed and supporting infrastructure*

<b>Equipment</b>	<b>Subtotal</b>	<b>TOTAL</b>
Pay per view L-band antenna	20,000€(x1.5) = 30,000€	<b>30.000€</b>
10 PCs for data management, 10 automatic weather stations : measuring temperature, relative humidity, pressure, wind direction, wind speed, solar radiation) + data acquisition and data management software + communications (GSM or GPRS-IP or ETHERNET or WI-FI): located as follows <ul style="list-style-type: none"> <li>• 2 stations in Senegal: Dakar</li> <li>• 3 stations in Mauritania</li> <li>• 3 stations in Cape Vert</li> <li>• 1 station in The Gambia</li> <li>• 1 station as a spare (without installation)</li> <li>• Maintenance training in these countries</li> </ul>	PCs: 2,000€(x10) = 20,000€ Stations: 12,200€(x10)= 122,000€ Installation: 7,000€(x9)= 63,000€ 4-year maintenance: (4x) 3,000€ (x9) = 108,000€ Maintenance training: 5000€(x4)=20,000€	<b>333.000 €</b>
6 sea level radars: <ul style="list-style-type: none"> <li>• 2 Miros radar stations (Tide gauges)</li> <li>• 4 standard radar stations (tide gauges)</li> <li>• 6 station base and protection</li> </ul> located as follows <ul style="list-style-type: none"> <li>• 1 Miros station in Senegal: Dakar</li> <li>• 1 Miros station in Cape Vert: Mindelo</li> <li>• 1 standard station in Mauritania: Nouadhibou</li> <li>• 1 standard station in Cape Vert: Praia</li> <li>• 1 standard station in Senegal: St. Louis</li> <li>• 1 standard station in The Gambia: Banjul</li> <li>• Spare parts (without installation)</li> <li>• Maintenance training in these countries</li> </ul>	2 radar stations with agitation measurement (including installation, maintenance (four years), monitoring reports and delivery of raw data): 48.000 (x2) = 96.000€ 4 standard radar stations (including installation, maintenance (four years), monitoring reports and delivery of raw data): 39.000 (x4) = 156.000€ Station base and protection for 6 stations: 2.500 (x6) = 15.000€ Training: 20.000€ Spare parts: 38.000€	<b>325.000€</b>
<ul style="list-style-type: none"> <li>• 3 Computers for port wave forecast models (SAPOs) located as follow:               <ul style="list-style-type: none"> <li>- 1 computer in Senegal: Dakar</li> <li>- 1 computer in Mauritania: Nouakchott</li> <li>- 1 computer in Cape Vert: Mindelo</li> </ul> </li> <li>• 3 SAPOs placed in Madrid-AEMET like replicas.</li> <li>• Navigational charts digitization</li> </ul>	PCs: 2,000€(x6)= 12,000€ Digitalization 3,000€(x3)= 9,000€	<b>21.000€</b>
<ul style="list-style-type: none"> <li>• 1 computer for the implementation satellite products in Dakar</li> </ul>		<b>2.000€</b>
<b>Total:</b>		<b>711.000€</b> <i>(taxes not included)</i>

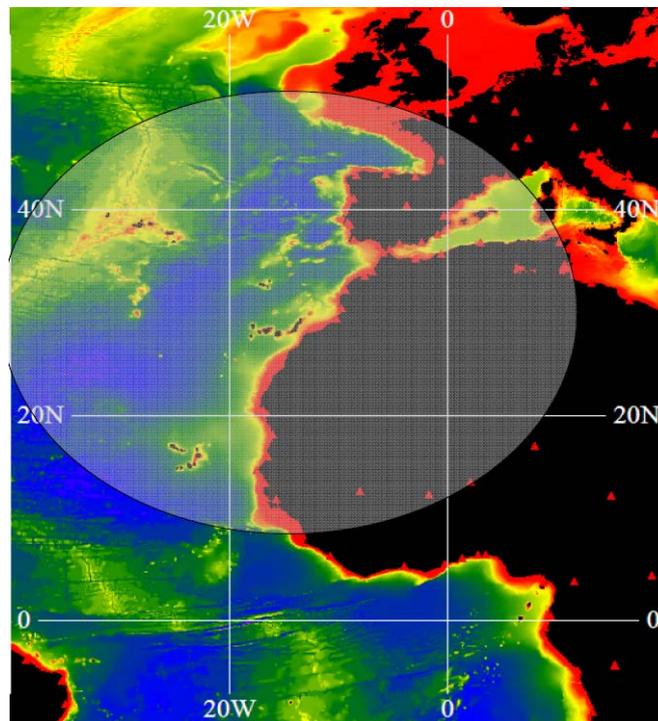
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### 8.1.2. *Equipment provided by Spain*

#### A) L-band antenna

An L-band antenna is operated by SEASNET (Survey of the Environment Assisted by Satellite) group from ULPGC since 1996. Information from a constellation of multi-spectral IR and VIS satellite sensors are near-real time obtained for the geographical domain of the Regional Node. Value-added biophysical products (SST, Chlorophyll, SLA, SST fronts, CLA fronts, Ekman pumping), are obtained and disseminated on an automated and routine basis.

Due to the fact that the products obtained directly of this antenna are not free (20.000 €/year) and therefore they will be not directly transferable at the end of the pilot project, the supply of these products (Sea Level Anomalies and Surface Currents) will finish in January, 2011



*Domain of the L-band antenna*

#### B) Eumetcast stations

Three EUMETCAST stations are currently in operation at AEMET's facilities in the Canary Islands. Eumetsat data and value-added products developed by SAFs (Satellite Application Facility), within the Regional Node's geographical domain, are near-real time downloaded and disseminated. Specific ocean products are obtained from the Ocean and Sea Ice Satellite Application Facility (OSI-SAF), as well as complementary products from Nowcasting SAF (SAF-NWC). Such EUMETCAST stations are implemented in practically every NMS in Africa with EU funding and EUMETSAT support. System can be used to disseminate products generated in the region as well.

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### 8.1.3. *Other existing equipment*

Three existing stations in Dakar (Senegal), Palmeira (Cape Vert) and Nouackchott (Mauritania)<sup>3</sup>. These instruments are maintained by NOAA (USA).

### 8.2. Personnel Expenses:

#### 8.2.1. *Expenses covered by the Trust-fund at WMO:*

- July-December 2009: 46.000€to contract three full-time graduates
- 2010: 122.000€to contract three full-time graduates
- 2011-2012: 87.000€to contract two full-time graduates
- January-June 2013: 43.500€to contract two full-time graduates
- 8,150 € to contract one communications expert during the first phase of the project (1 month). (Coordination: WMO)

#### 8.2.2. *Expenses covered by each partner institution:*

- Part time dedication of PhDs and graduates from AEMET, ULPGC and PE.
- Part time dedication of one Technical Focal Point for each partner institution.

(At the expenses of the general budgets of the Members institutions through regular salaries)

## **9. Deliverables by Spain**

### 9.1. Monitoring

- Near-real time remote sensing observation within the Node Region:
  - a. Management and maintenance of the L-band antenna Value-added products delivery for the Node Region, derived from L-Band, and EumetCast facilities.
  - b. Maintenance of EumetCast facilities at the Canary Islands
  - c. Data management from Eumetsat, SAF-NWC and OSI-SAF subject to EUMETSAT Data Policy
- Continuous near-real time validation of remote sensing observations against available in-situ data (buoys, sea level radars, and automatic weather stations).

### 9.2. Modeling

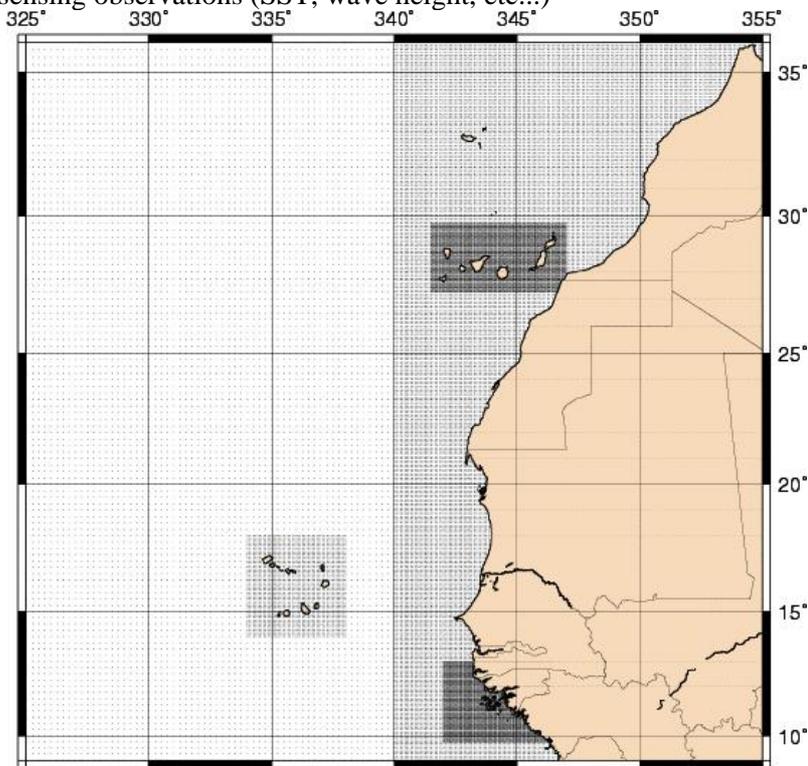
- Development and operation of experimental, pre-operational and operational meteorological marine forecasting models:
  - a. Oceanic scale: WAM model within the region 36°N-35°W / 9°N/5°W with a resolution from 15' to 5' up to 72h (+3D).
  - b. Local scale: SWAM model over a 25km<sup>2</sup> region with resolution between 200m and 500m.
  - c. Port scale: SAPO model (nested in SWAM) with resolution of few meters.

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<sup>3</sup> See “Africa Sea Level Network” (<http://www.iode.org/glossafrica>)

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- Continuous near-real time validation of both experimental and pre-operational models, against in-situ data (buoys, sea level radars, and automatic weather stations) and against remote sensing observations (SST, wave height, etc...)



*Geographical domains of marine meteorology forecast models*

### 9.3. Products developed by AEMET

- 10m winds (ECMWF interpolation)
- Wind waves: direction and intensity
- Total swell: direction and intensity
- Sea surface temperature (SAF-ocean and ice using satellite data: NOAA, GOES-E and MSG)
- ECAM outputs global/local scale
- Bathymetric charts (resolution:1')
- Maximum parameters maps for individual waves
- Swell period maps
- Statistics description maps for groups of waves
- Swell directional distribution plots

### 9.4. Data dissemination, and products and services delivery

- Design and maintenance of restricted web-based portal. (probably under the domain: [www.afrimet.org/marinemet/](http://www.afrimet.org/marinemet/))
- Exchange technical information with experts from Senegal, Mauritania, Cape-Vert and The Gambia through VPN.
- Data submission to RSMC-Dakar through WMO-WIS and VPN. An expert in communications will be contracted to carry out a survey about this topic. The results will set the best way to submit the data.
- Products dissemination through, for instance, the project web.
- Dissemination by a project web is easy, if “data pull” is sufficient and if product size is compatible with (poor) internet access of some countries. Dissemination via EUMETCast should be relatively easy as well, subject to discussion and agreement with

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EUMETSAT, and would allow “data push”. (Could be a second step after starting through web). Dissemination via GTS to be considered if products are small enough and if the users are all at NMHSs

- Annual reports in English and French.

### **10. Capacity building activities**

#### 10.1. Training to build capacities in the general curricula adopted by WMO

- Place: the RTC at Toulouse
- Duration: 2-4 weeks
- Beneficiaries: 3 people (Senegal, Mauritania and Cape Vert)
- Budget: 20.000€
- Date: to be scheduled (in the 2<sup>nd</sup> half of the 2009)

#### 10.2. Training to build capacities in the general curricula adopted by WMO

- Place: UK-Met Office
- Duration: 2-4 weeks
- Beneficiaries: 1 person (The Gambia)
- Budget:
- Date to be scheduled (in the 1<sup>st</sup> half of the 2010)

#### 10.3. Short-term course for meteorologists

- Place: Las Palmas University and AEMET’s Canary Islands Delegation
- Duration: 5 days
- Content: 3 modules. Meteorology (2 days), Oceanography (2 days), computer-data management (1 day) with both theoretical and practical aspects.
- Number of participants: 4 people (the coordination committee of: Mauritania, Senegal, Cape Vert and The Gambia). Other West African countries could attend the course with different budget.
- Budget: 12.100€(within the Las Palmas’ Plan) / WMO trust fund
- Beneficiaries: Meteorologists from west Africa
- Required level: Engineers, high-level technicians, according to the demand of the countries. Candidates’ CVs will be submitted to adapt the content of the course.
- Date: to be scheduled

#### 10.4. On job training fellowship under AEMET’s Call conditions and Schedule

- Place: AEMET + PE + ULPGC
- Duration: 2 months
- Content: Oceanography, remote sensing, in-situ observation, wave modelling and others issues.
- Number of participants: 1 person
- Budget: without an additional cost for the project (within the Las Palmas’ Plan) / WMO trust fund.
- Beneficiaries: staff of Phase-1 partner countries (Senegal, Cap Vert and Mauritania)
- Required level: Engineers or PhDs
- Date: to be scheduled

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### 10.5. Specific courses for in-situ instrument maintenance and management

- Scheduled with the installation of the instruments (coastal automatic weather stations and mareographs).
- Budget: included in the equipment budget.

### 10.6. Users' formation courses

- Place: regional meteorological services of Mauritania, Senegal, The Gambia and Cape Vert.
- Addressed to:
  - Sea safety authorities (i.e. HASSMAR – “Haute Autorité pour la Surveillance et la Sécurité en mer” in Senegal)
  - Port Authorities
  - National Navy
  - Fishing Research and Protection (i.e. DPSP – “Direction de la protection et de la Surveillance des Pêches” in Senegal)
- Budget: 20.000€(within the Las Palmas' Plan) / WMO trust fund.

### 10.7. Ad-hoc technology transfer (in a continuous and long-term basis)

New products, techniques, methodologies and model developments will be transferred to NMHS's according to their needs and capabilities. For example, two technology transfer actions are already being performed within the project:

- Implementation of the new WAM (ECMWF-nested) at DMN/Senegal (May-July 2008).
- Training of an expert from DMN/Morocco in Port-scale wave forecasting model (SAPO) at PE/Spain (summer 2008).

## **11. Duration and calendar of the project**

The table below summarizes the foreseen schedule of activities

<b>Action</b>	<b>Subtotal</b>	<b>Dates</b>	<b>Places</b>	<b>Managed by</b>
Equipment to be purchased	711.000 €	2010-2011	Recipient countries	WMO
Pay per view for L-band antenna operation	30.000€	2009-2010	Spain	Spain
Contract three full-time graduates	298.500 €/year	2009-2013	Spain	WMO/AEMET
Contract communications consultant (1month)	8.150 €(10, 800 USD)	2010	Geneva - Dakar	WMO
Short-term course for meteorologists	12,100 €	2011	Spain	Spain
Specific course for marine meteorology forecasters	20,000 €	2 <sup>nd</sup> half of 2009	Spain	Spain
In-situ instrument maintenance and management course	included in the equipment budget	when the equipment is installed	Recipient countries	Companies
Users' formation courses	20,000 €	2012	Recipient countries	Recipient countries and supervised by Spain
Ad-hoc technology transfer	--	Continuous	Recipient countries	Spain

## **12. Commitments of the Participants on the Project**

### **12.1. Commitments of WMO**

- To implement a proactive support on the project attending the meetings as part of the project Coordination Committee.
- To manage the African Program Trust-fund in order to achieve the objectives as stated in this ToR.
- To contact participants on each one of the actions.
- To organize the meetings and courses and to carry out the logistic facilities: travels, venues etc.
- To make the necessary arrangements for the provision of the equipments and the contract of the staff, if needed.
- To seek the integration of the project within the WMO regional cooperation structures, specifically the WMO RA I.
- To fulfil the commitments of the Memorandum of Understanding between WMO and AEMET, regarding the implementation of this project

### **12.2. Commitments of Spain**

Recognizing that warnings related to marine meteorology are the responsibility of National Meteorological Services (NMHSs) and of the Regional Specialized Meteorological Centre (RSMC) at Dakar (RSMC-Dakar), and that the Spanish deliverables described above on Point 9 may be valuable to NMHSs and to the RSMC-Dakar, AEMET's commitment is:

- To coordinate and guarantee the activities of the Project stated above on point 9.
- To coordinate and take care of Capacity Building activities as stated above on point 10, with the logistic support of WMO and financial matters ensured by the Trust-fund Africa.
- To provide a web-based portal for user access to a regional marine meteorology research and forecast activities and services.
- To provide marine meteorology research and capacity building to the partners as stated above on point 10, with the logistic support of WMO and financial matters ensured by the Trust-fund Africa.
- To cooperate with existing operational service delivery mechanisms.

### **12.3. Commitments of the Regional Specialized Meteorological Centre (RSMC)**

- Disseminate data and product.
- Management meteorological information from automatic weather stations in both Senegal and the rest of countries.
- Develop "guidance products" – daily – to the NMHSs, with interpretation of the global products from the deterministic models and the EPS.
- Make available these products (web - password protected) and develop an archive of these products.
- Be engaged in the capacity building activities.
- Implement process for archival data and products.
- Implement a process for evaluation and feedback on the effectiveness of these products and enhancement of warnings produced by the NMHSs.
- Evaluate the time and resources needed to achieve the project.

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### **12.4. Commitments of NMHS participants in the project**

- Provide the necessary information for the development of the project.
- Designate participants and responsible according the profile for each action.
- Support the local organization of the action, if located in its country.
- Provide the basic infrastructures for the installation of the instruments.
- Perform the long-term operation and maintenance of the instruments, in other to assure the sustainability of the project.
- Be engaged in the long-term maintenance the automatic weather stations.
- Be engaged in the long-term maintenance the sea radar levels
- Be engaged in the long-term maintenance the SAPOs
- Support to the technical team for the implementation of the project's facilities.
- Involve in all the activities related with the project.
- Get a high level of technical knowledge to maintenance the equipments and the quality of products after the end of the project.

### **13. Sustainability of the project and future activities**

The actions developed will be evaluated once per year in the Directors Meetings. In these meetings, progress will be reviewed.

Future activities and actions could be developed after the annual Directors Meetings, according to new information and decisions.

### **14. Monitoring and reporting**

The development of the project shall be object of regular planning and reporting as follows:

- Annual work plans shall be prepared before the 1<sup>st</sup> of January of each calendar year jointly by the AEMET, WMO and participating NMHSs.
- Annual monitoring reports shall be prepared and distributed during the first month of each calendar year jointly by the AEMET, WMO and participating NMHSs
- Financial reports will be prepared by WMO every six months (in January and July)
- After the end of the project the WMO shall prepare a final report including the final accounts which shall detail the funds received and all the expenditure concepts during the development of the project.
- The participants shall prepare any other report or document which could be deemed necessary for information of the relevant parties.

### **15. Activities developed by the consultants.**

15.1. Three (2009-2010) or two (2011-2013) High Degree Graduates should manage the basic aspects of the Project and their specific assignments would be:

- Coordination and Management of real time satellital observation and its transmission to the RSMC-Dakar.
- Coordination, management and maintenance of the hardware system associated with the L-band antenna.
- Maintenance and management of the Operational dedicated Servers.
- Models and remote sensing observations operational validation the together with data of the sea level radars networks and that of the available buoys in the Region.

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- Maintenance of the Private Virtual Communication Network with RSMC-Dakar and eventually with the NMHS involved in the project.
- Exchange of technical information with the technical personnel and experts of the NMHS of Senegal, Mauritania, The Gambia and Cape Vert, both by email and telephone.
- Support of the development and implementation of the new products and services developed by AEMET, Las Palmas University and State Ports.
- Provide marine meteorology research and capacity building to the participants, with the logistic support of WMO and financial matters ensured by the Trust-fund Africa, and in particular, develop specific capacity building activities on the project.
- Provide a web-based portal, shared or joint with RSMC-Dakar, for user access to a regional marine meteorology research and forecast activities and services.
- Specific Developments of the SAPOs programs for the ports and beaches of the north-western African coast (Mauritania, Senegal, The Gambia and Cape Verde).
- Digitalization of ports and beaches nautical charts specified for obtaining bathymetric chart to be used later on in the models.
- Oceanic Models Developments and Parameterizations, and to obtain of new physical parameters within the marine environment of the North-Western African Basin.
- Models validation tasks.
- Coordination with the participant NMHS for the implementation of new developments.
- Organization training activities.
- Elaboration of annual reports both in Spanish and English and an annual abstract in French.

15.2. One consultant expert in telecommunications with following specific assignments:

- Study the telecommunications networks in Senegal, Mauritania, Cape Vert and The Gambia taking into account the described specifications in the ToR for the project. Fact finding site visits may be necessary.
- Prepare recommendations on the project implementation and preparation of technical specifications for the tender process.
- Elaborate specific plans for site acceptance and technology transfer to West African countries.
- Participate in the evaluation of the proposals received, preparing an evaluation report.